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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.   | CONFIRMATION NO. |
|--|-------------|----------------------|-----------------------|------------------|
| 10/766,465   | 01/27/2004  | Ling Ma              | IR-2444 CIP (2-3869)  | 3194             |
| 2352 7590 02/07/2007<br>OSTROLENK FABER GERB & SOFFEN<br>1180 AVENUE OF THE AMERICAS<br>NEW YORK, NY 100368403 |             |                      | EXAMINER<br>KIM, SU C |                  |
|  |             |                      | ART UNIT              | PAPER NUMBER     |
|  |             |                      | 2823                  |                  |
| SHORTENED STATUTORY PERIOD OF RESPONSE   |             | MAIL DATE            | DELIVERY MODE         |                  |
| 3 MONTHS   |             | 02/07/2007           | PAPER                 |                  |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

|                              |                                      |                                  |  |
|------------------------------|--------------------------------------|----------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/766,465 | <b>Applicant(s)</b><br>MA ET AL. |  |
|                              | <b>Examiner</b><br>Su C. Kim         | <b>Art Unit</b><br>2823          |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 18 December 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1 and 4-10 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 4-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 February 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some    \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/18/2006 has been entered.

### ***Claim Rejections - 35 USC § 102***

Claims 1, & 4-9 are rejected under 35 U.S.C. 102(e) as being anticipated by Amali et al. (US 7045859)

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Re claim 1, Amali discloses a synchronous semiconductor; and a control semiconductor device(Power MOS gate device), a semiconductor body of a first conductivity which includes a channel region of a second conductivity and a major surface(Fig. 3, first conductivity 11(N+ type), a second conductivity 12(P type));

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an active region (Fig. 3, 12) formed in said semiconductor body, said active region including a trench less than 0.5 microns (claim 7, 0.4 micron) wide extending through said channel region and a gate structure (Fig. 3, 17) disposed in said trench which includes a gate oxide layer (Fig. 3, 15, 16) disposed at least on said sidewalls of said trench and a gate electrode disposed adjacent said gate oxide layer, conductive regions of said first conductivity (Fig. 3, 11) adjacent said trench in said channel region (Fig. 3, 12); and a metallic contact (Fig. 3, 25) in contact with said conductive regions; and a termination structure (Fig. 6), said termination structure including, a termination trench having a slanted sidewall (Fig. 6, the trench 100 is considering slanted sidewall) formed in said semiconductor body (Fig. 6), and a grown field oxide layer (Fig. 6, 101) formed in said termination trench below said major surface, a polysilicon field (Fig. 6, 102) plate formed over said field oxide layer, and a low temperature oxide body over said polysilicon field plate, wherein said field oxide layer is thicker than said gate oxide layer (Fig. 6, field oxide 101 is thicker than gate oxide 15) wherein said metallic contact extends over said low temperature oxide body (Fig. 6, metal contact 30, low temperature oxide 103), and wherein said semiconductor body of said first conductivity extends from said trench to the bottom of said termination trench (Fig. 6, 11).

Re claim 4, as applied to claim 1 above, Amali discloses all the limitations include, trench includes an oxide mass (Fig. 6, oxide mass 46) formed at its bottom said oxide mass being thicker than said gate oxide layer (Fig. 6, oxide mass 46 is thicker than gate oxide 16).

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Re claim 5, as applied to claim 4 above, Amali discloses all the limitations include, a semiconductor substrate of said first conductivity (Fig. 6, 11), said semiconductor body (Fig. 6, 12) being formed over said semiconductor substrate (Fig. 6, 11), wherein said conductive regions are electrically connectable to said semiconductor substrate through invertible channels adjacent said trench (Fig. 6, Power MOSFET).

Re claim 6, as applied to claim 5 above, Amali discloses all the limitations include, the conductive region are source region (Fig. 6, source 9)

Re claim 7, as applied to claim 1 above, Amali discloses all the limitations include, the depth of the trench has been selected to achieve an optimum figure of merit (Fig. 6, trench)

Re claims 8 & 9, as applied to claim 1 above, Amali discloses all the limitations include, the trench is a strip or a cell (Fig. 6, the trench has strip or cell with length and width)

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 10 is rejected under 35 U.S.C. 103(a) as being obvious over Amali et al. (US 7045859) in view of Bulucea et al. (US 5298442)

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The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(I)(1) and § 706.02(I)(2).

Re claims 10, as applied to claim 9 above, Amali discloses all the limitations include, the trench is cell

However, Amali fails to teach the cell is hexagonal

Buluceal discloses the trench is hexagonal cell(Fig. 8)

Therefore, it would have been obvious to one of ordinary skill in the art at the time of applicant(s) claimed invention is made to provide Amali with a semiconductor device includes trench is a hexagonal cell taught by Bulucea in order to produce "maximizes the gate dielectric breakdown voltage and also provides position of voltage

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breakdown initiation to allow use of controlled bulk semiconductor breakdown. "(Column 1 lines 59-61)

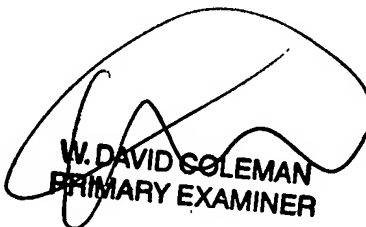
### **Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Su C. Kim whose telephone number is (571) 272-5972. The examiner can normally be reached on Monday - Thursday, 9:00AM to 7:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Su C. Kim  
2/1/2007

  
W. DAVID COLEMAN  
PRIMARY EXAMINER